

REMARKS

This amendment is submitted concurrently with a request for continued examination (RCE) of the present application, and in response to the final Office Action mailed June 18, 2004. Claims 2-20, 30-34 and 53-68 are presented for examination. Claims 1, 21-29 and 35-52 have been canceled, and Claims 53-68 have been added.

The claim amendments and new claims presented herein are fully supported by the specification and claims as originally filed. Claims 10, 14 and 30 have been amended to incorporate the limitations of original Claim 1. Claims 2-9 have been amended to be dependent from Claim 10 instead of Claim 1. New Claims 53-68 are supported by original Claims 2-9. No new matter has been added.

Applicants note with appreciation the statements in the Office Action that the novelty of the claimed invention lies in the details of the method by which the dielectric is etched, and the suggestion that these details be included in the independent claim. The claims have been amended in accord with this suggestion. Specifically, independent Claim 1 has been replaced with three independent claims (Claims 10, 14 and 30) corresponding to three of the embodiments described in the specification and drawings. Applicants also note with appreciation that Claim 9 has not been rejected under any of the grounds of rejection in the Office Action. Applicants therefore respectfully submit that the claims are now in condition for allowance.

Rejection of Claims 1-8, 21 and 26 under 35 U.S.C. § 102(b) over Grill et al.

Claims 1-8, 21 and 26 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,413,852 to Grill et al. Initially, Applicants note that Claims 1, 21 and 26 have been cancelled, and therefore the rejection of these claims is now moot. With regard to the other claims, Applicants respectfully traverse this rejection.

Amended Claims 2-8 now depend from Claim 10. In the invention defined by Claim 10, the portion of the first dielectric material is removed by a method

comprising the steps of: forming a cap on each conductive interconnect, the cap having a lateral extent greater than that of the conductive interconnect, thereby masking portions of the dielectric layer adjacent to the conductive interconnect and leaving other portions of the dielectric layer not masked; and removing a portion of the first dielectric material in areas of the dielectric layer not masked by the cap, thereby forming the opening in the dielectric layer. It is therefore a feature of the invention defined by Claim 10 that the cap formed on each conductive interconnect masks portions of the dielectric layer adjacent to the conductive interconnect, such that during etchback the sidewalls of the conductive interconnect remain in contact with the first dielectric material. Applicants respectfully submit that this feature (at least) is not disclosed by Grill et al., as follows.

The Grill et al. patent is directed to a method of forming a multilevel interconnect structure containing air gaps. The method begins with formation of a dielectric layer 110-140 (Figs. 1A-1B), and then conductor 185 is embedded in the dielectric layer (Figs. 1C-1E). A portion of the dielectric layer is then removed, to form openings 190 (Fig. 1F). Grill et al. fail to disclose the formation of a cap on conductor 185, and therefore fail to disclose a cap which masks portions of the dielectric layer adjacent to the conductor, such that during etchback sidewalls of the conductor remain in contact with the dielectric layer. Indeed, it is recognized in the Office Action on pages 5 and 6 that the novelty of the claimed invention lies in this feature of the claimed method.

Since Grill et al. fail to disclose the above-identified feature of Claim 10, Applicants respectfully submit that Claim 10 is not anticipated by the Grill et al. patent. Claims 2-8, which include all of the limitations of Claim 10, also are not anticipated by the Grill et al. patent. Applicants therefore request withdrawal of this rejection.

Rejection of Claims 10-20, 22-25 and 27-34 under 35 U.S.C. § 103(a) over Grill et al.

Claims 10-20, 22-25 and 27-34 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Grill et al. Initially, Applicants note that Claims 22-25 and 27-29 have been canceled, and therefore the rejection of these claims is moot. With regard the other claims, Applicants respectfully traverse this rejection.

Claims 10-20 are directed to two embodiments of the present invention, which are illustrated in Figures 1(a)-1(d) and 2(a)-2(d). In these embodiments, the portion of the first dielectric material is removed by a method comprising the steps of: forming a cap on each conductive interconnect, the cap having a lateral extent greater than that of the conductive interconnect, thereby masking portions of the dielectric layer adjacent to the conductive interconnect and leaving other portions of the dielectric layer not masked; and removing a portion of the first dielectric material in areas of the dielectric layer not masked by the cap, thereby forming the opening in the dielectric layer. It is therefore a feature of these embodiments that the cap formed on each conductive interconnect masks portions of the dielectric layer adjacent to the conductive interconnect, such that during etchback the sidewalls of the conductive interconnect remain in contact with the first dielectric material. Applicants respectfully submit that this feature (at least) is neither disclosed nor suggested by Grill et al., as follows.

As discussed previously, Grill et al. fail to disclose or even suggest performing the etchback using a cap which masks portions of the dielectric layer adjacent to the conductor, such that sidewalls of the conductive interconnect remain in contact with the first dielectric material. In fact, Grill et al. teach that the etchback is preferably performed with an anisotropic etch process, using the conductive wiring structures themselves as a mask (col. 5, lines 58-60). Grill et al. therefore provide no motivation to modify their method to use a cap having a lateral extent greater than that of the conductive interconnect as a mask.

Since Grill et al. fail to disclose or even suggest the above-identified feature of Claims 10-20, Applicants respectfully submit that these claims are patentable over the Grill et al. patent. Applicants therefore request withdrawal of this rejection.

Claims 30-34 are directed to another embodiment of the present invention, which are illustrated in Figures 4(a)-4(f). In this embodiment, the conductive interconnect has a top portion with a lateral extent greater than that of lower portions of the interconnect, thereby masking areas of the first dielectric material, and the first dielectric material is removed in areas not masked by the top portion of the conductive interconnect. The conductive interconnect is embedded in the dielectric layer by first forming an opening in the dielectric layer, then removing a top portion of the dielectric material adjacent to the opening, thereby rounding top corners of the opening, and then filling the opening with a conductive material. It is therefore a feature of this embodiment that the conductive interconnect has a top portion with a lateral extent greater than that of lower portion of the interconnect, formed by rounding the corners of the opening prior to filling the opening with conductive material. Applicants respectfully submit that this feature (at least) is neither disclosed nor suggested by Grill et al., as follows.

As discussed previously, the Grill et al. patent is directed to a method of forming a multilevel interconnect structure containing air gaps. The method begins with formation of a dielectric layer 110-140, then cavities 150 and 160 are formed in the dielectric layer, and then conductors 185 are embedded in the dielectric layer. Grill et al. fail to disclose or even suggest rounding the corners of the cavities prior to forming the conductors.

Since Grill et al. fail to disclose or even suggest the above-identified feature of Claims 30-34, Applicants respectfully submit that these claims are patentable over the Grill et al. patent. Applicants therefore request withdrawal of this rejection.

Conclusion

Applicants have properly traversed each of the grounds for rejection in the Office Action, and therefore submit that the present application is now in condition for allowance. If the Examiner has any questions or believes further discussion will aid examination and advance prosecution of the application, a telephone call to the undersigned is invited.

No fee is believed to be due for the submission of this amendment. If any fees are required, however, the Commissioner is authorized to charge such fees to Deposit Account No. 09-0458.

Respectfully submitted,



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